
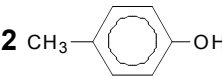
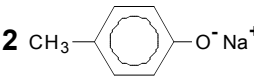
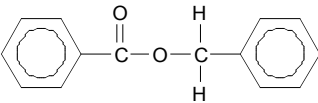
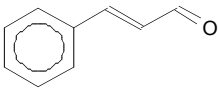
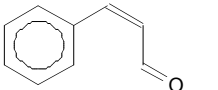


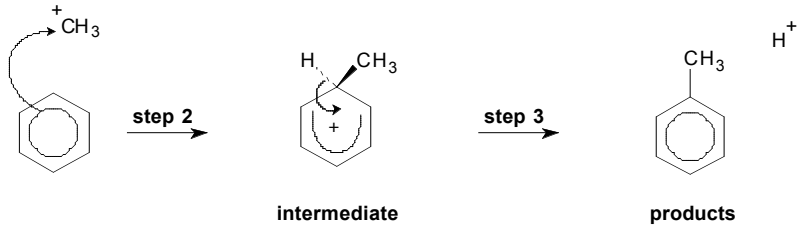
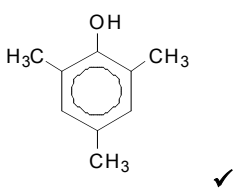
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Qu.	Expected answers:	Marks:
1 (a) (i)	<p>balanced equation to give -COO⁻ ✓ + H₂O ✓</p> <p>allow C₇H₅O₂⁻</p>	[2]
(ii)	<p>4-methylphenol reacts (phenylmethanol does not) ✓</p> <p>... because phenols are (more) acidic / donate H⁺ more easily AW ✓</p>	[2]
(b) (i)	H ₂ / hydrogen	[1]
(ii)	<p>  + 2 Na →  + H₂ </p> <p>phenoxide/sodium phenoxide structure / formula ✓</p> <p>rest the equation also correct and balanced ✓</p> <p>allow C₇H₇ONa but NOT -NaO or O-Na</p>	[2]
(c)	H ⁺ / acid / named strong acid eg H ₂ SO ₄ / HCl	[1]
(i)	 <p>displayed ester group ✓</p> <p>rest of the ester ✓</p>	[2]
		[Total: 10]

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Qu.	Expected answers:	Marks:
2 (a) (i)	 ✓	[1]
(b) (i)	C=C double bond does not rotate ✓ two different groups on each carbon (of the C=C) AW ✓	NOT on "each side" of the C=C [2]
(ii)	trans because H / groups are on opposite sides AW ✓	[1]
(iii)	any formula that shows the H on the same side – eg  ✓	[1]
(c) (i)	aldehyde / C=O / carbonyl ✓	[1]
(ii)	$\text{C}_6\text{H}_5\text{CHCHCHO} + 2 [\text{H}] \longrightarrow \text{C}_6\text{H}_5\text{CHCHCH}_2\text{OH}$ ✓	allow $\text{C}_9\text{H}_{10}\text{O}$ [1]
(d)	method silver nitrate ✓ ammonia / ammoniacal ✓ warm / heat ✓ silver (mirror) / brown ppt forms ✓ explanation silver ions <u>reduced</u> / $\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$ ✓ aldehyde <u>oxidised</u> to a carboxylic acid ✓ correct structure – eg $\text{C}_6\text{H}_5\text{CHCHCOO}^- / \text{COOH}$ ✓ quality of written communication mark for correct spelling, punctuation and grammar in at least two sentences ✓	[8]
		[Total: 15]

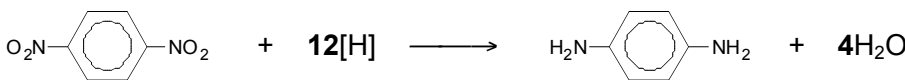
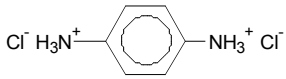
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Qu.	Expected answers:	Marks:
3 (a) (i)	 <p>curly arrow from π-bond towards the carbon of $^+\text{CH}_3$ ✓</p> <p>intermediate structure of the intermediate ✓ curly arrow from C-H bond ✓</p> <p>products structure of methylbenzene and H^+ shown ✓</p> <p>(ii) accepts an electron pair ✓</p> <p>(iii) $\text{H}^+ + \text{AlCl}_4^- \longrightarrow \text{AlCl}_3 + \text{HCl}$</p>	<p>intermediate must have the “+” within the delocalised area</p> <p>allow HCl as product if Cl^- is shown with the intermediate [4]</p> <p>NOT a “lone” pair [1]</p> <p>[1]</p>
(b)	$\text{C}_6\text{H}_6 + \text{CH}_3\text{Cl} \longrightarrow \text{C}_6\text{H}_5\text{CH}_3 + \text{HCl}$ products ✓ rest of the equation also correct ✓	[2]
(c) (i)	(benzene) ring is <u>activated</u> ✓ lone <u>pair</u> from oxygen is delocalised / interacts with the π electrons around the ring / AW or diagram ✓ greater electron density (around the ring) ✓ attracts $^+\text{CH}_3$ / electrophiles more easily ✓	<p>ignore references to the inductive effect</p> <p>[4]</p>
(ii)		<p>[1]</p>
		[Total: 13]

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Qu.	Expected answers:	Marks:
4 (a) (i)	water / evidence of a solution in water – eg (aq), 'dil', '6M' or 'conc' for HCl ✓ a named strong acid or alkali (heated under) reflux / a suitable enzyme at around 37°C ✓	NOT conc HNO ₃ or conc H ₂ SO ₄ [2]
(ii)	amino acids ✓	[1]
(iii)	correct structure for one of the amino acids ✓ correct ionic form for reagent used in a(i) – eg $\begin{array}{c} \text{H} & \vdots & \text{O} \\ & & // \\ \text{H}-\text{N}^+-\text{C}-\text{C}-\text{OH} \\ & \\ \text{H} & \text{H} \end{array} \quad / \quad \begin{array}{c} \vdots & \text{O} \\ & // \\ \text{H}-\text{N}-\text{C}-\text{C}-\text{O}^- \\ & \\ \text{H} & \text{H} \end{array} \quad \checkmark$	[2]
(iv)	reaction with water to split/break down the compound ✓ peptide bond in the compound is broken / diagram to show AW ✓	[2]
(b) (i)	a carbon with four different <u>groups</u> attached ✓ a chiral carbon /centre ✓ different spatial / 3-D arrangement (of the groups) ✓ (stereo)isomers / mirror images are non-superimposable / molecules are asymmetric ✓ ANY 3 out of 4 marks	[3]
(ii)	contains 2 chiral centres ✓ each can have 2 (stereo)isomers/ 2x2 possibilities AW ✓	[2]
(iii)	use naturally occurring / enantiomerically pure amino acids OR use a stereospecific catalyst / enzyme / micro-organisms OR separate the mixture using a suitable method ✓	[1]
(iv)	higher doses are required ✓ the drug /other stereoisomers may have (harmful) side-effects ✓	[2]
		[Total: 15]

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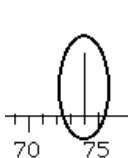
Qu.	Expected answers:	Marks:
5 (a) (i)	Diamino <u>two/2</u> amine groups ✓ 1,4 their position on the ring / numbering of carbons around ring (or shown on a diagram) ✓	[2]
(b) (i)	reduction / redox ✓	[1]
(ii)	tin and HCl ✓ conc acid under reflux ✓	or H ₂ gas + Ni/Pd catalyst [2]
(iii)	 H ₂ O as product ✓ and the equation balanced ✓	[2]
(c) (i)	accepts H ⁺ using the lone pair (on N) ✓ which is donated/forms a (dative) covalent bond ✓	either mark can be obtained with a good diagram [2]
(ii)	 correct structure with charges shown ✓✓ one mark for either: just one neutralised, both neutralised, but without Cl ⁻ , both neutralised, but no charges shown	[2]
(iii)	hexane-1,6-diamine is a stronger base because: electrons move towards the N (due to the inductive effect) (in hexane-1,6-diamine) ✓ the lone <u>pair</u> from N is (partially) delocalised around the ring (in diaminobenzene) ✓ so the electron pair is more easily donated / H ⁺ more easily accepted (in hexane-1,6 diamine) ora ✓	[3]

question 5 continued overleaf

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Qu.	Expected answers:	Marks:
	<p>question 5 continued</p> <p>(d) (i) eg fire resistant / bullet proof clothing / cycle tyres / tennis rackets ✓</p> <p>allow any use where a tough flexible material is needed [1]</p> <p>(ii) <u>condensation</u> (polymerisation) ✓</p> <p>eg</p> $n \text{ H}_2\text{N}-\text{C}_6\text{H}_4-\text{NH}_2 + n \text{ HOOC}-\text{C}_6\text{H}_4-\text{COOH} \longrightarrow \left[\text{NH}-\text{C}_6\text{H}_4-\text{NH}-\text{C}(=\text{O})-\text{C}_6\text{H}_4-\text{C}(=\text{O}) \right]_n + 2n \text{ H}_2\text{O}$ <p>structure of benzene-1,4-dicarboxylic acid ✓</p> <p>amide /peptide bond displayed ✓</p> <p>repeat unit of correct polymer indicated ✓</p> <p>formula of water shown as the product in an equation ✓</p>	[5]
		[Total: 20]

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Qu.	Expected answers:	Marks:
6 (a)	<p>Molecular ion peak circled ✓</p> <p>Compound X has $M_r = 74$ ✓</p> <p>Empirical formula has $M_r = (36 + 6 + 32) = 74$ (so must be the same as the molecular formula) ✓</p> 	[3]
(b) (i)	compound X is not an aldehyde <u>or</u> ketone / not a carbonyl compound ✓	[1]
(ii)	compound X does not contain a C=C double bond/ is not an alkene / is not a phenol ✓	[1]
(c)	<p>structure 1 ethyl methanoate ✓</p> <p>structure 3 propanoic acid ✓</p>	[2]
(d)	<p>presence or absence of relevant peaks (in the context of any of the structures) ...</p> <p>peak at ~1750 / 1680-1750(cm^{-1}) for C=O ✓</p> <p>peak at ~1250 / 1000-1300(cm^{-1}) for C-O ✓</p> <p>no peak at 2500 – 3300(cm^{-1}) ✓</p> <p>structures possible or ruled out ...</p> <p>structures 3 is ruled out / can only be structure 1 or 2 ✓</p>	[4]
(e)	<p>correct structure:</p> $\begin{array}{c} \text{H} & \text{O} & & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{C}-\text{H} \\ & & & \\ \text{H} & & & \text{H} \end{array} \quad \checkmark$ <p>reasoning:</p> <p>peak at ~2 / 2.0-2.9(ppm) is due to $\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{CH}_3 \end{array} \quad \checkmark$</p> <p>peak at ~3.7 / 3.3-4.3(ppm) is due to $-\text{O}-\text{CH}_3 \quad \checkmark$</p> <p>relative peak area is 1:1/equal as both groups have the same number of protons ✓ AW</p> <p>peak(s) not split as there are no protons on the neighbouring carbons ✓</p> <p>quality of written communication for use and correct organisation of at least two of the scientific terms: ppm, environment, methyl, proton, adjacent, singlet (doublet etc) ✓</p> <p>allow max 1 as ecf from the wrong structure for valid reasoning from the δ value</p>	[6]
		[Total: 17]